FROM LITERACY TO ACUMEN
Opportunities for Librarians in Undergraduate Data Science Education
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1. EMERGENCE OF THE DATA SCIENCE DISCIPLINE

- With the rapid growth in data access and availability, there is a growing need across sectors for expertise in turning data into actionable knowledge. Data science (DS) is an emerging discipline to address this need and DS programs are increasingly common in institutions of higher education.

- The National Academies of Sciences, Engineering and Medicine convened a committee to present a vision for the future of DS education at the undergraduate level. On May 2, 2018, they published their final report[1] outlining their findings and recommendations.

- They highlight the need for a curriculum that teaches beyond data literacy, toward "data acumen", or the ability to "make good judgements and decisions with data"[1].

- Given the infancy of this discipline, and current efforts to shape its future, librarians have an opportunity to work with educators to enrich the DS curriculum and meet the challenges of defining a new discipline in a rapidly changing environment.
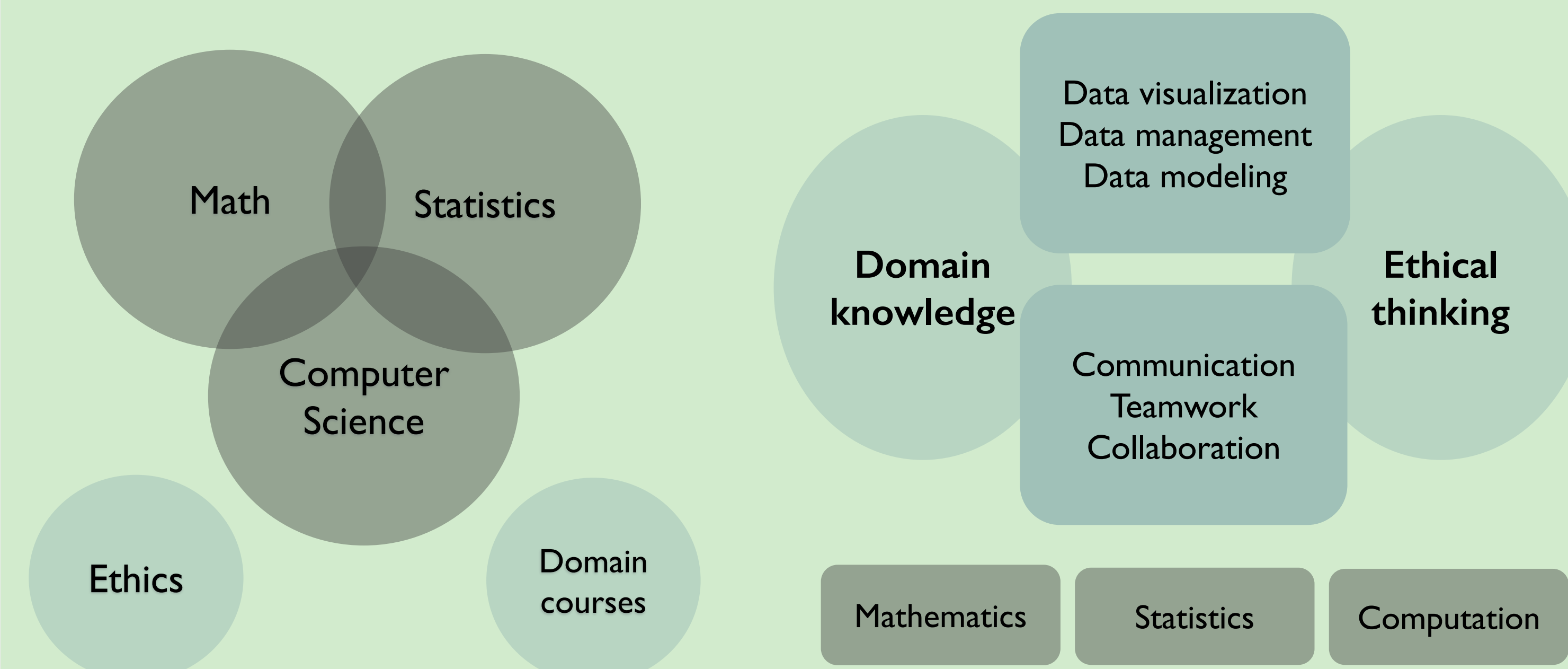
2. METHODS: IDENTIFYING SYNERGIES

- I map information literacy and data information literacy frameworks to the framework put forth by the National Academies for DS education.

- I identify areas of synergy and potential new competencies that will be needed to support this cross-domain discipline.

- I examine curricula in undergraduate DS programs to identify opportunities for librarian engagement and propose concrete ideas for the role the library can play.

- I focus on aspects of the National Academies report that most resonate with the role of librarians in undergraduate education. Aspects related to the long-term evaluation of DS education and recruitment of diverse students to the discipline, while important, are de-emphasized in this poster.

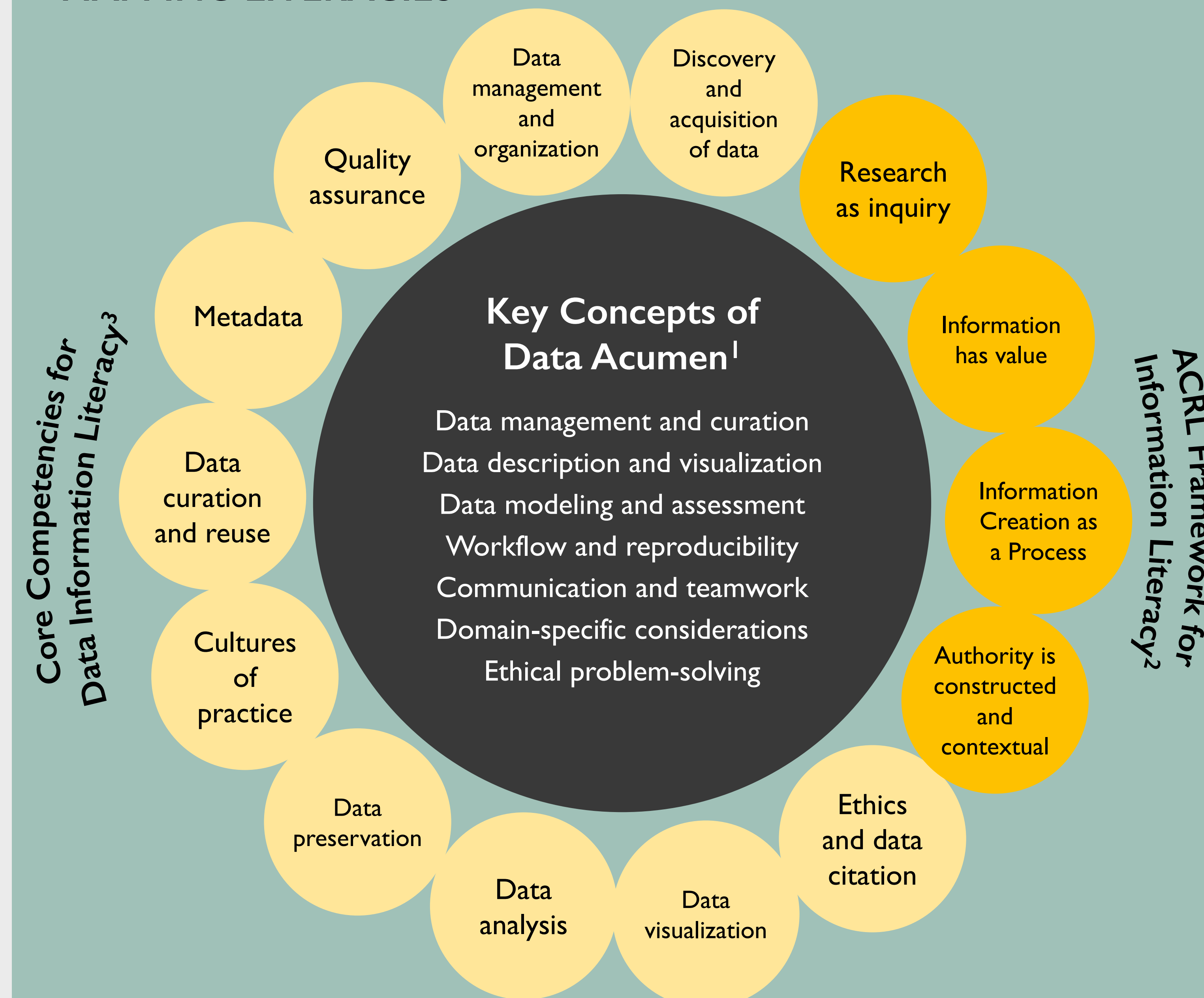## THE EVOLUTION OF DATA SCIENCE EDUCATION

A review of current DS majors reveals a core curriculum drawn from three main areas. Some programs include a stand-alone ethics course, and some include a track of domain-specific coursework.
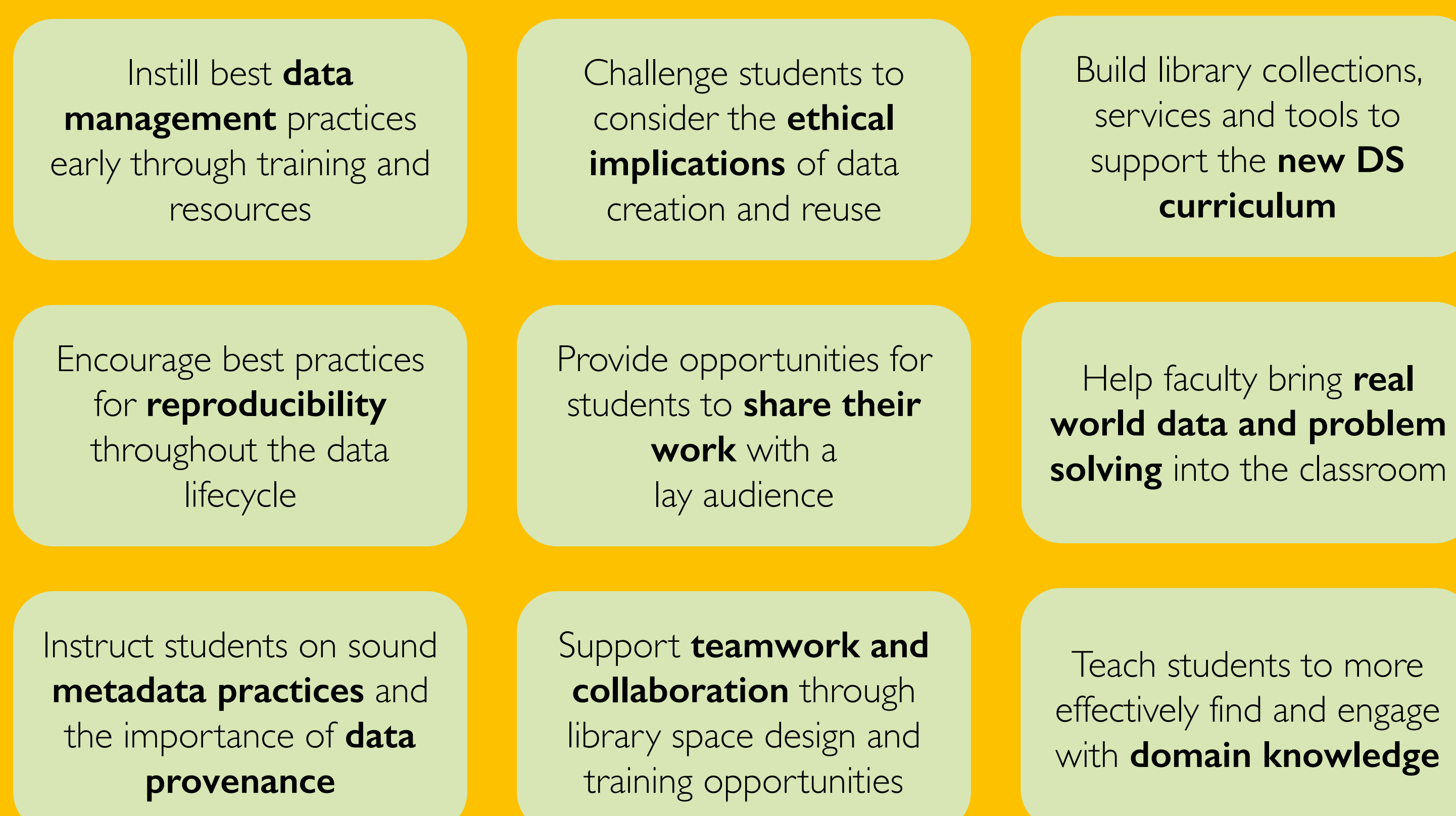
The National Academies envisions a future DS education that will develop as a discipline in its own right. Ethical practice will be infused throughout the curriculum and key hard and soft skills will be emphasized.

Venn diagram: Math, Statistics, Computer Science, Ethics, Domain courses

Diagram: Domain knowledge, Ethical thinking, Data visualization / Data management / Data modeling, Communication / Teamwork / Collaboration, Mathematics, Statistics, Computation

MAPPING LITERACIES

Key Concepts of Data Acumen[1]

Data management and curation
Data description and visualization
Data modeling and assessment
Workflow and reproducibility
Communication and teamwork
Domain-specific considerations
Ethical problem-solving

Core Competencies for Data Information Literacy[3]: Data management and organization, Quality assurance, Metadata, Data curation and reuse, Cultures of practice, Data preservation, Data analysis, Data visualization, Ethics and data citation

ACRL Framework for Information Literacy[2]: Discovery and acquisition of data, Research as inquiry, Information has value, Information Creation as a Process, Authority is constructed and contextual

KEY OPPORTUNITIES FOR LIBRARIANS

- Instill best **data management** practices early through training and resources
- Challenge students to consider the **ethical implications** of data creation and reuse
- Build library collections, services and tools to support the **new DS curriculum**
- Encourage best practices for **reproducibility** throughout the data lifecycle
- Provide opportunities for students to **share their work** with a lay audience
- Help faculty bring **real world data and problem solving** into the classroom
- Instruct students on sound **metadata practices** and the importance of **data provenance**
- Support **teamwork and collaboration** through library space design and training opportunities
- Teach students to more effectively find and engage with **domain knowledge**

3. CONSIDERING NEW LIBRARIAN SKILLS

- To better support the growing numbers of DS students and faculty, librarianship should consider new competencies and skills.

- These new skills can be leveraged to improve library systems, evaluate library services and collections and strengthen the research of library faculty.

- While not all institutions will have DS majors, the emphasis on data acumen is likely to become more prominent in all disciplines. Thus, for librarians, even basic skills can enhance our support of this cross-curriculum trend.

- Foundational statistics, and a basic understanding of the concept of DS workflows and the tools that enable collaboration and reproducibility of these workflows, can go a long way in positioning the librarian to support DS education.

- Areas of specialization like data visualization, data management and curation, and open science and reproducibility can be enriched with an eye toward the practice of DS.

4. How you can SUPPORT DATA SCIENCE ACUMEN

- 'Case studies' of open real world data accompanied by contextual information like journal articles, policy documents and news can serve as rich, instructional resources useful for teaching DS across the disciplinary curriculum.

- Librarians are already active in data management, data curation and reproducible science. Raising awareness among faculty about these services may help establish a foothold in emerging DS curriculum.

- Consider how librarians can help students hone their 'soft skills' of teamwork, collaboration and communication and frame these skills within the context of data acumen.

- Build guides or lists of open educational resources and open source tools to enable faculty to integrate DS into their curriculum in a cost effective way.

REFERENCES

1. National Academies of Sciences, E. (2018). *Data Science for Undergraduates: Opportunities and Options*. https://doi.org/10.17226/25104
2. American Library Association. (2015, February 9). Framework for Information Literacy for Higher Education. Retrieved May 3, 2018, from http://www.ala.org/acrl/standards/ilframework
3. Carlson, J., Fosmire, M., Miller, C. C., & Nelson, M. S. (2015). Determining Data Information Literacy Needs: A Study of Students and Research Faculty. In *Data Information Literacy: Librarians, Data and the Education of a New Generation of Researchers* (pp. 11–34). Purdue University Press.